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CENTRAL INTELLIGENCE AGENCY

INFORMATION REPORT

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SUBJECT	Personnel and Scientific Processes of the Professor Hertz Nuclear Institute at Agudzeri	DATE DISTR.	19 August 1955
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This is UNEVALUATED Information

THE SOURCE EVALUATIONS IN THIS REPORT ARE DEFINITIVE.
THE APPRAISAL OF CONTENT IS TENTATIVE.
(FOR KEY SEE REVERSE)

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1. The Professor Hertz Nuclear Institute at Agudzeri (N 42-55, E 41-07) was established in 1945, in the buildings of a former sanatorium, about eight kilometers southeast of Sukhumi. The institute had been enlarged until as late as 1949. About 120 Germans worked at the institute. The Soviet personnel varied around 80 persons, and included 30 scientists and expert assistants. The institute was controlled by the Ministry of Internal Affairs (MVD) in Moscow, with General A.I. Kochlavashvili acting as liaison officer between the institute and the MVD. He was the only Soviet at the institute who was superior to Professor Hertz. The Soviet administration, with the exception of the guard unit, and all others at the institute were subordinate to Professor Hertz. However, Professor Hertz, whose deputy was Kvarchava (fnu), a Soviet, was more or less controlled by his Soviet personnel.

2. The glass blowing plant of the institute was controlled by foreman Max Saegel, who had arrived with his family and with Professor Hertz in 1945. The glass blowing plant was primarily in charge of the production of diffusion pumps with accessories for Professor Hertz. Because of high waste during the experiments, these delicate instruments had to be produced continuously and the shape of the pumps was frequently modified.

3. In June 1946, Professor Hertz was still working on the first Soviet requests to detect and demonstrate the separation of neon isotopes by means of a diffusion pump using mercury vapor as diffusion gas. An exchangeable nozzle pipe extended into the area in which diffusion was effected. At the lower end of this pipe the vapor jet was mixed with neon and subsequently condensed in the cooling coils following in the system. Neon was fed into the unit just above the root of the nozzle tube. The water jacket also extended into this area. The distance between the inner wall of the cooling jacket and nozzle pipe varied slightly, about five mm. The light isotopes were tapped off shortly above the condensation trap at the return flow (reflux) to the mercury vaporizer and then

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NOTE: Washington distribution indicated by "X"; Field distribution by "#".)

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directed through interposed measuring instruments to the next pump of the cascade. No information was available on the process between the pump stages. The cascade unit was composed of two and later three stages. Each cascade was pre-evacuated to 10^{-3} Torr and then further evacuated to 10^{-6} Torr. The constant operational pressure effected after the evaporization process had started and the neon had been fed into the pump was not definitely remembered as 10^{-4} Torr. This type of pump, developed from a jet pump or vacuum pump, was later actually used as a high vacuum pump to evacuate the systems to 10^{-6} Torr. The so-called diffusion separation pump was further develped in another direction. The project involving the separation of neon isotopes was completed in 1946.

4. The next project requested by the Soviets covered the separation of uranium isotopes. Uranium hexafluoride (UF_6) was known to be the only uranium compound that could be used for this purpose, and no information was obtained indicating that other compounds have been involved. Impure crystalline UF_6 in steel containers was supplied in sufficient quantities. Mercury, being easily affected by the UF_6, could no longer be used for the diffusion process; and, since the system applied for neon was found effective because of its high speed of circulation, "fluorized hydrocarbon" was chosen as the new "diffusion partner". This material, an oily substance, was hard to obtain, but was used during the entire period of experimentation. Both UF_6 and hydrocarbon had to be purified in a chemical laboratory. Although a separation of uranium isotopes could have been effected without the injection of a second gas, the fast flowing oil vapor (hydrocarbon) was probably used as a carrier to obtain a much higher speed of circulation and consequently a higher speed of separation. This was learned to be the advantage of Professor Hertz's system, compared to the slow diffusion process effected by pressure gradient diaphragms only.

5. The next stage of the project involved research to determine whether these two materials, UF_6 and the hydrocarbon, would chemically combine during the diffusion process, and whether their temperatures of sublimation would lead to an adequate factor of separation. Fluorized hydrocarbon had a volatilization temperature of 250° C under standard pressure and accordingly less under a pressure of 10^{-4} Torr. During the third stage, experiments were made to find a chemically and physically appropriate diaphragm for both gases. For this purpose, the type of pump as described in Paragraph 3 was modified. Professor Hertz had already tried to use a metal tube diaphragm, about 40 cm long and about 20 mm in diameter, fitted with slots in the middle, about one mm x 40 mm, for the neon-mercury diffusion. The metal and the shape of the slots were modified to adapt these diaphragms for UF_6 and hydrocarbon. These tubular diaphragms were fitted snugly on either side of the nozzle. In order to exchange the diaphragms, the pumps had to be cut open at the lower adjustment nozzles and rewelded. Vaporized oil was injected into the pump with a loud whizzing noise through the upper nozzle. UF_6 was fed into the space, about five mm wide, between the internal wall of the cooling jacket and the external wall of the diaphragm tube, and diffusion was to be effected inside the tube by the vapor pressure drop along the diaphragm. The low pressure of this gradient and the speed of the gas flow produced a suction of the light UF_6 isotopes through the diaphragm. The enriched light isotopes were discharged shortly above the condensor stopper of the heavy fraction and directed through measuring tables to the inlet of the next pump stage. The heavy enrichment, oil and UF_6, flowed to the evaporation unit, from which point the same cycle started all over again. To obtain a higher degree of enrichment, this process was repeated with the light isotopes in the next two or three pump stages. The metal diaphragm tubes with longitudinal slots, which were used during the initial stage of development, were useful in proving that fluorized hydrocarbon was well suited as diffusion gas along with UF_6; however, the metals were not resistant against UF_6 corrosion, and because the type of slots was inadequate to produce useful separations, no satisfactory results could be obtained.

6. During the next stage of development, the pump was arranged in a slanting position, with its basic layout remaining unchanged. After about mid-1948, tubes of a dull green shade without slots were used in this arrangement to replace the slotted diaphragm tubes as described above. Before these new type of tubes were adopted, experiments had also been conducted with slotted tubes of pure nickel. It was learned that Dr. Reinhold Reichmann had developed a new diaphragm material consisting of nickel oxide, which proved to be chemically

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resistant as well as practical in regard to the shape of its pores. This innovation was considered an important step in the development. New experiments were conducted to test porosity and the effects of corrosion on the material with a diffusion pump. Another problem was the reaction of the material to fluorized hydrocarbon, which, due to its oily consistency, tended to fill the pores. These experiments, however, proved that the oil as well as the nickel oxide diaphragm could be used for diffusion. By early or mid-1949, it had been finally established that all three new materials, UF_6, fluorized hydrocarbon, and nickel oxide, could be used for the separation process of uranium isotopes.

7. In about fall 1948, Professor Hertz had planned to use different and larger equipment to effect diffusion. This plan was realized by Dr. Justus Muehlenpfordt, who developed the diffusion boxes.

8. Muehlenpfordt's first project was the development of a deaerator to separate air particles (elements) from UF_6 before the gas was fed into the diffuser. Since the air would have also disturbed the diffusion process, it had to be evacuated from the diffusion pumps. This air separator was observed in about mid-1948, when Muehlenpfordt had proved its qualifications and when the unit had to be dismantled and packed over night to be picked up by an airplane in the morning. For this purpose the glass ampules were cut off. The air separator unit involved a condenser which, by means of sub-cooling, effected the crystallization of UF_6 vapor and caused the air to escape. It was learned that the air was exhausted completely. Liquid air, which had been used at first, was too cold and also effected a condensation of air particles. [redacted] 25X1 warmer liquids [redacted] were subsequently used. Impure 25X1 UF_6 had a yellowish shade, while the purified UF_6 was colorless. Alfred Schimor was [redacted] in charge of the purification of UF_6, which was done in the chemical department, probably with the deaerator.[2]

9. The first pair of diffusion boxes was observed between about mid-1948 and about mid-1949. The second set which was externally identical or very similar to the first one was used between mid-1949 and mid-1950. The new diffusion boxes, however, probably had three instead of two pipe connections, but the dimensions seem to have been the same. [redacted] 25X1 [redacted] a system related to the diffu- 25X1 sion pumps may have been involved. [redacted] 25X1 this system was developed on the experiences obtained with the pumps.

10. The diffusion boxes were made of steel sheets, 50 to 10 mm thick, with five rigidly connected walls and a lid-type front to which the pipe connections and the "internal system" were fitted. The inside of the walls was nickel-coated and the outside reinforced against high pressure by T-profiles. The The connecting pipes were rigidly connected to the lid. Their outer ends were provided with a threaded flange, while the inner ends extended into the diaphragm casing to which they were apparently fixed. The unit included two such boxes installed in one so-called temperature casing. When the unit was in operation, 15 to 20 pipes, most of them of a small diameter and some of them bundled, extended from the temperature casing. Some of these pipes led to a cooling unit, while others extended over the measuring table. The wires of about 20 heating elements also extended to the measuring table where they were connected to a reflecting galvanometer. [redacted] 25X1 [redacted] 25X1 [redacted] the lower connecting pieces of the two boxes 25X1 were connected by a pipe, to which 12 or more sampling ampules were attached. The above-mentioned bundles of pipes leading to the measuring table extended from the upper part of the boxes. The diaphragm casings inside the boxes were estimated at 20 x 50 x 80 cm, and were made of thin nickel sheets slightly trapezoidal at two sides. They were presumably closed on five sides, while the bottom was probably open. Each of the two leaning walls was provided with four apertures, into which dull grey diaphragms of postcard size were fitted. These four diaphragms covered about 50 percent of the entire wall. Four or five Bourdon gauges, operating with fluorized hydrocarbon (oil pressure gauges), were also inter-connected between the two boxes. The gauges connected to one box were sealed by welding at one end, while the gauges of the other box were fitted with valves at both ends. The measuring range reached from 0 to 100 cm.

1. [redacted] diffusion box functioned as follows: A mixture of UF_6 and oil was fed into the space between the diffusion box and the casing, where it travelled the path of minimum resistance and reached the internally cooled diaphragm area, tending to reach the cooled zone; the light isotopes separated from the mixture and passed through the diaphragm to be enriched on the inside. The unit was probably equipped with tapping devices for the enrichment of light isotopes. Like the diffusion pump, the boxes condensed the heavy isotopes, collected them in the vaporizer, and repeated the entire cycle. Some kind of device was reportedly interposed between the two diffusion boxes to effect the enrichment of the light isotopes and to make them collect in one box while the heavy isotopes collected in the other. [redacted] it was possible that the boxes were cross-connected so that, similar to the pump cascades, but in this case crosswise and alternately, the light fraction would continuously travel from the lower or possibly from the middle pipe connection of one box to the upper pipe connection of the other box. [redacted] a later version of the diffusion boxes was provided with three connecting pieces. [redacted] a "Zirkulationstransport" occurred in the boxes. This circulation process probably involved a continuous cycle between the two boxes within one of the units, and was probably not effected by the pumps which were only used to evacuate the cascades before operation. [redacted] the UF_6 oil vapor system of the glass pumps was also applied for the diffusion boxes, although the presence of oil instead of mercury in the pressure gauges would have been explained already by the corrosive effects of UF_6. This system had the great advantage of Professor Hertz's development and was, therefore, probably also used for the boxes.

2. In late 1949 or early 1950, the second pair of diffusion boxes was successfully tested. The figure "four percent" was frequently mentioned in connection with the degree of enrichment.

3. In late 1949, the institute was visited by an engineer from a Soviet plant for vacuum apparatuses. This plant from which he came was ordered to produce 50 diffusion boxes of the type and size used at the institute as an experimental series for mass production. The engineer had to familiarize himself with the technical requirements for this type of production and inspected the second pair of diffusion boxes in operation. The boxes were reportedly to be produced in the usual drawing press process. The Soviet engineer, however, expecting serious difficulties to be involved in the production, primarily because he feared that the drawing press process would not produce a proper density, tried to persuade everybody that this production would be technically impossible.

4. Dr. Reinhold Reichmann was in charge of the development of diaphragms. This project was initiated in 1946, and was primarily to find a proper material and advantageous structure of the pores for plate diaphragms capable of resisting fluor and to effect a satisfactory diffusion of UF_6 and fluorized hydrocarbon, respectively. No material specifications were given by the Soviets. During the same time, Dr. Boris Ikert worked on basic experiments involving corrosive effects of UF_6 and fluorized hydrocarbon. Until early 1948, only flat postcard-sized plates were used for experimental purposes. Diaphragms tested during these experiments included:

   a. Coarse meshed copper nets, which were rolled in order to contract the pores;

   b. Copper nets, coated with CU oxides and sintered;

   c. Sintered ceramics;

   d. Silver nets, coated with silver oxides and sintered;

   e. Nickel wire nets, coated with nickel oxides and sintered.

The diaphragms were again tested against corrosion and, by air pressure, for characteristics of the pores. prior to 1948, only occasional success had been obtained; the experiments with ceramics had failed completely, while nickel meshes, sintered with oxide coatings, were found to be the best qualified for diaphragm materials.

15. In the spring of 1948, experiments were conducted, reportedly on Soviet suggestion, with tubular diaphragms. A short time later, the diffusion pumps developed by Professor Hertz were equipped with dull grey nickel oxide tubes, which proved to be an enormous success for Dr. Reichmann. Nickel oxide without net reinforcement, "Dragakant" (sic), some type of alga, and some other undetermined agent were mixed and kneaded by calender rolls. This substance was put through a plodder, which, at the rate of about one cm per second, pressed it into tubes which dropped into an acetone bath. The tubes were finally sintered in an atmosphere of hydrogen.

16. In the fall of 1948, the Soviets ordered 800 tubular diaphragms to be delivered as soon as possible. The order was accomplished in three months by working three shifts. Dr. Reichmann died during this period and was replaced by Yermin (fnu), a Soviet, who continued the same procedure. During these three months, the institute was visited by an unusually large number of Soviet engineers and managers, including a general, who all were interested in this production and in related fields. The 800 tubes were reportedly required for some large cascade to be erected at some undetermined place for experimental purposes and to serve as the basic stage for a production plant which was to be built. These tubes, 50 cm long, 20 mm in diameter, and 0.1 to 0.3 mm thick, were 10 cm longer than the ones used at the institute.

17. In 1949, Dr. Heinz Barwich and several scientists visited Kefirstadt for a few weeks. Kefirstadt was obviously a cover name, sections of an experimental cascade were located in some courtyard there. an institute similar to Professor Hertz's, but possibly larger and newer, rather than a production plant, was possibly involved.

18. In 1949, Dr. Ikert, who had continued to conduct corrosion experiments after 1948, announced the following result: The corrosion resistance of nickel oxide diaphragms could be obtained only by some sort of vaxination (sic) process, involving a pre-treatment with pure fluor gas and a final treatment with UF_6 gas. The corroded layer produced during this treatment would protect the material against the much smaller attack of UF_6 occurring during the operation. Dr. Ikert continued his efforts and anticipated proving that even "vaxinated" materials could still be effected by corrosion. These experiments, however, were presumably conducted only to determine the exact degree of the corrosion.

19. A 20-ton cyclotron, which Professor Hertz had brought from Berlin, stood in the institute. It was never used and apparently was not intact.

20. Shortages in the supply of materials to the Hertz Institute included tungsten, wrapped wires, high vacuum grease, and Jena-type fire-resistant glass and melting glass. These materials required a delivery time of three or four months. UF_6 was available in sufficient quantities, but fluorized hydrocarbon was in short supply and had to be used with care.

21. Electric power was generally received from Sukhumi. The transmission line, however, was often defective, and the 200-ampere, 360-volt emergency generator could scarcely cover the power requirements of the institute. Another generator of the same capacity could not meet the civilian requirements, because many electric heaters were used.

22. [redacted] 25X1
Ardenne Institute worked on three projects, which included an ultracentrifuge handled by Ardenne himself and his assistant, Erwin Suckow, an engineer. The centrifuge was reportedly activated by high frequency power. No results could be obtained, since the instrument repeatedly disintegrated. Dr. Max Steenbeck worked on a giant spectrograph for mass analyses. Although the spectrograph had been completed, this project encountered difficulties because the technical problem of vaporizing metallic uranium could not be solved. Activities were conducted to determine optimum vaporization conditions.

23. On the following pages are drawings of the area and some of the equipment used at the institute, as well as a list of institute personnel:

a. Location of Professor Hertz Institute.

b. List of the personnel of the Professor Hertz Institute.

c. Glass diffusion pump used for separation of neon isotopes.

d. Graphic reproduction of diffusion process in a pump equipped with a tubular diaphragm.

e. Sketch of deaerator.

f. Overall sketch of diffusion box with measuring table.

g. Detailed sketch of diffusion box.

h. Timetable of activities at Professor Hertz Institute.

i. Diffusion pump developed at Professor Hertz Institute.

24. "Oil" (fluorinated hydrocarbon) (fluorierter Kohlenwasserstoff?) was put into the diffusion chambers (Diffusionskaesten). Max Sternkopf built 50 metal pumps which were used as diffusion pumps.

25. UF_6 was always called a code name-"Mars". "Dragakant" was a type of plant or algae, possibly a seaweed (paragraph 15 above).[3]

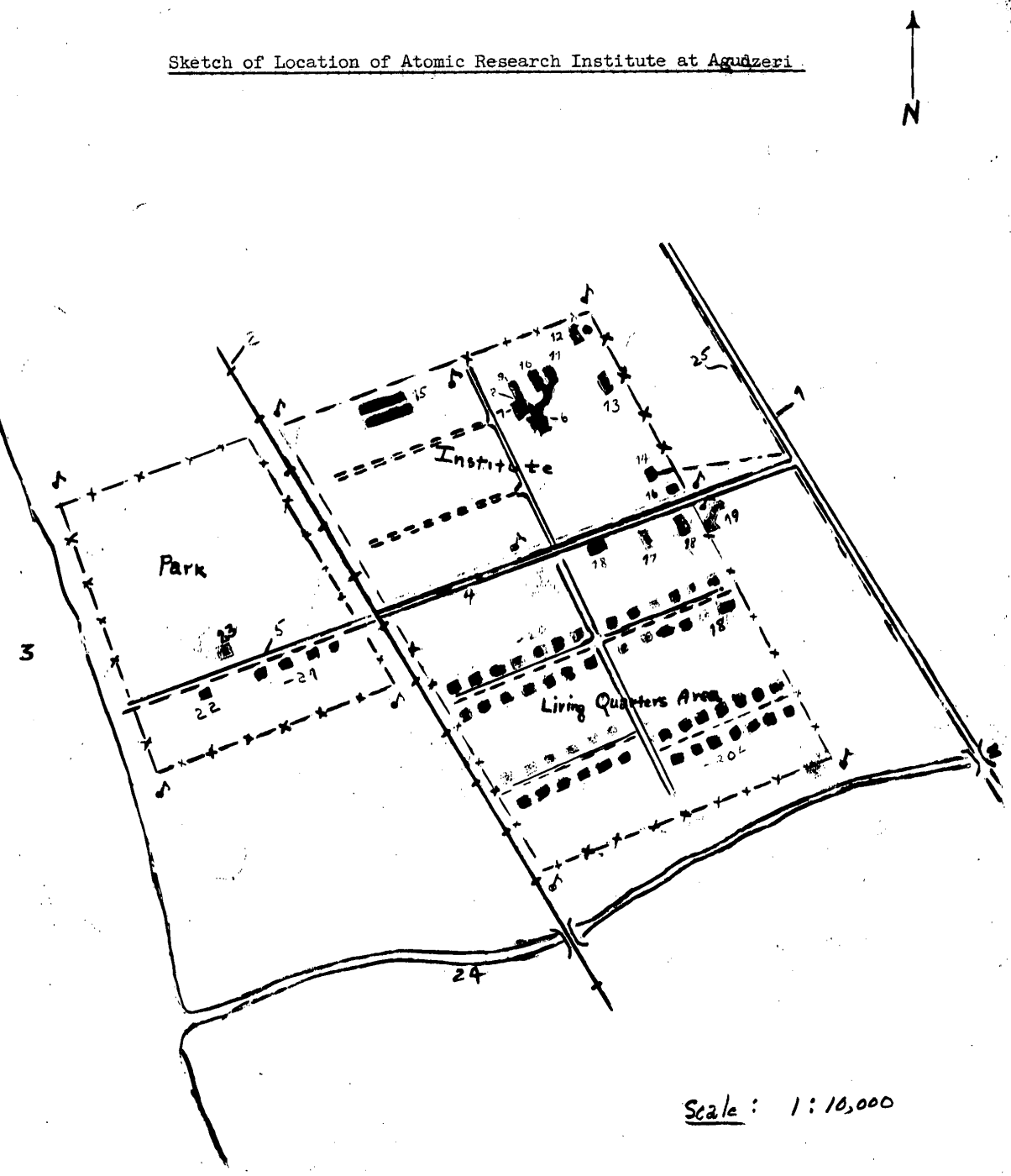
[redacted] Comments 25X1

1. Kvarchava should perhaps be I.F. Kvartskhava, a member of the Institute of Physics and Geophysics, Department of Mathematics and Natural Science, of the Georgian Academy of Science, who has published in the field of neuclear physics.

2. [redacted] 25X1

3. "Dragakant" probably refers to the gum, tragacanth.

Sketch of Location of Atomic Research Institute at Agudzeri



Location Sketch of the Atomic Research Institute at Agudzeri

Legend:

1. Asphalt road from Sukhumi.
2. Single-track railroad line from Sukhumi.
3. Beach.
4. Connecting road to the coast, newly asphalted east of railroad line.
5. Unpaved part of road.
6. Main institute building; former sanatorium, three stories high, and about 70 meters long.
7. Muehlenpfordt Laboratory: new single-story building, about 30 meters long. The diffusion boxes were constructed here and put into operation.
8. Electric workshop: new single-story building, about 25 meters long; low-power work, precision work, mass spectrograph.
9. Glass blowing plant: new single-story building, about 25 meters long; production of diffusion pumps and later of accessories and measuring instruments.
10. Mechanical workshop: new single-story building, about 40 meters long; metal processing, production of deaerators, diffusion boxes, and similar equipment.
11. Electric workshop and transformer station: new single-story building, about 40 meters long; high-power work, transformers to convert the alternating current received from Sukhumi for institute purposes.
12. Oil-cracking plant and gas tank with a capacity of about 75 cubic-meters, new building; production and storage of heating gas for workshops and laboratories.
13. Chemical department: new single-story building, about 40 meters long; purification by means of sublimation of UF_6 and hydrocarbon for the current requirements of the physical laboratories; quantitative analyses of condensed uranium taken from sampling ampules; corrosion tests.
14. Power station with transmission cables from Sukhumi: three 200-ampere, 360-volt Diesel generators for emergency cases, including one for the institute, one for the quarters, and one in reserve.
15. Two storage sheds, each about 100 meters long.
16. Guardhouse (border troops).
17. Kitchen, mess halls, and clubs.
18. Old three-story billeting houses.
19. New single-story Soviet administration building housing Komendatura and plant management.
20. Fifty to seventy log houses for one or two families (reparation deliveries

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21. Four, old, wooden billeting houses.
22. New three-story villa of Professor Hertz.

23. New three-story guest house.

24. River.

25. Power transmission cable from Sukhumi.

Sentries.

Access to the institute was through a control point near the administration building located 200 meters from the highway. The institute area was separately fenced in, with the main entrance to the south, and another to the north. The railroad line was fenced in, and the connecting road was guarded by sentries.

List of Personnel Working at the Atomic Research Institute in Agudzeri

Professor Gustav Hertz	over-all control and diffusion pumps.
Ellen Mueller	secretary (Gerhard Mueller's wife),
Margarete Raedel	laboratory worker (Max Saegel's daughter),
Hardwin Jungclaussen	student of physics (Prof. Hertz's nephew),
Dr. Justus Muehlenpfordt	deaerator, diffusion boxes.
Walter Knable	chief laboratory.
Dr. Werner Schuetze	mass spectrograph.
Gerhard Saegel	precision mechanic (Max Saegel's son),
Dr. Reinhold Reichmann	development of diaphragm. (Reichmann died in 1948).
Yermin (fnu)	Reichmann's Soviet replacement.
Wilhelm Schreiber	mechanic (came from Worms and was repatriated).
Dr. Werner Hartmann	counter tubes.
Dr. Helmut Bumm	expert in metallurgy and vacuum soldering,
Dr. Heinz Barwich	mathematician,
Engineer Mauler (fnu)	nickel coating.
Professor Karshavin (fnu)	chief of the chemical laboratory, was at the institute only in 1949 for about a year,
Dr. Boris Ikert	corrosion tests.
Engineer Schimohr	chemical purification of UF_6 and fluorized hydrocarbon, chemical analyses,

Workshops and auxiliary installations:

Engineer Helmut Staudenmeier	institute engineer
Engineer Ernst Hottmann	designing office
Hans Hux and Herbert Boettner	draftsmen and designers
Esche (fnu)	mechanic

Electrical Workshops

Kurt Benner	armature winding
Anton Blitz	high-power electrician (transformers)
Hans Leverenz	low-power electrician
Erwin Walz	low-power electrician

Friedrich Weck	electrician (?).
Hermann Will	electrician (?).
<u>Glass blowing plant</u>	
Max Saegel	foreman and chief of workshop.
Rudolf Reiss	glass blower.
Josef Roetzer	glass blower.
<u>Mechanical workshop</u>	
Max Sternkopf	expert mechanic.
Helmut Bart	watchmaker and precision mechanic.
Eduard Hoeferle	lathe operator.
Guenter Janosch	precision mechanic.
Kurt Juergens	precision mechanic.
Rudolf Milbrandt	welder.
Helmut Oelschleger[1]	precision mechanic.
Hans Saegel	precision mechanic.
Rudolf Pophal	lathe operator.
Wilhelm Schreiber	diaphragm program.

1. Previously this name has been received as Oehlschagel and Oelschlagel.

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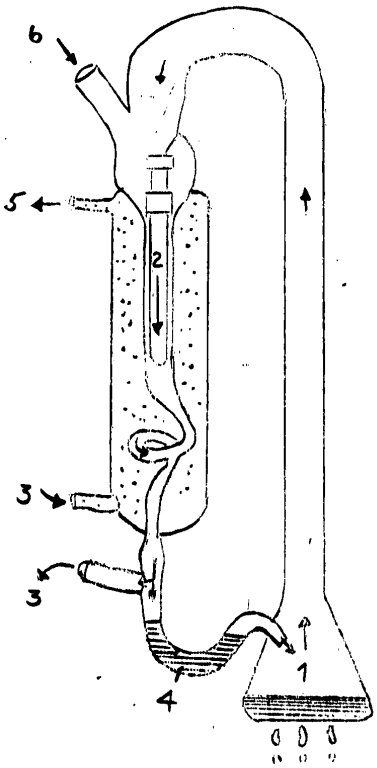
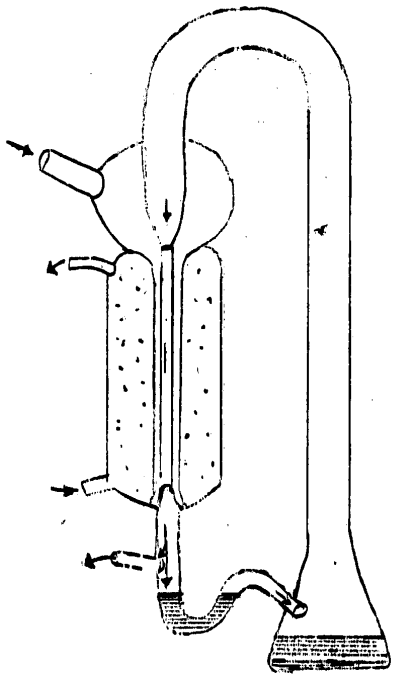
Sketches of Diffusion Pumps

I

II





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Sketches of Diffusion Pumps

Legend:

1. Vaporizer for mercury or fluorized hydrocarbon, operating by heat.
2. Diaphragm (metal tube with slots or porous metal oxide tube).
3. Exit of enrichment of light isotopes and transmission to next pump stage of the cascade, into which the gas is fed through the intake (6).
4. Condensed enrichment of heavy isotopes, simultaneously serving as condenser trap against the vaporizer.
5. Cooling water.
6. Intake of diffusion gases.

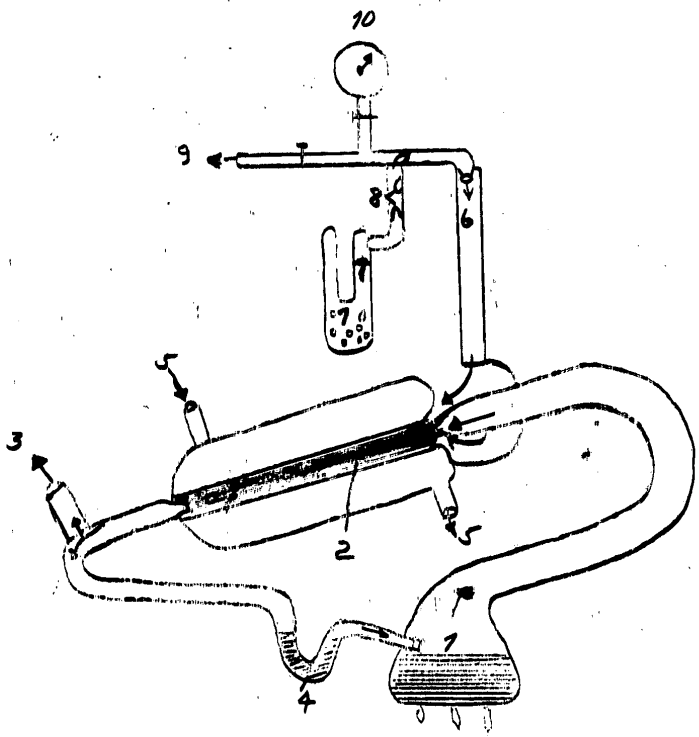
I. Old diffusion pump developed by Professor Hertz to demonstrate the separation of neon isotopes by means of mercury. This type of pump was modified and used as high vacuum pump, mercury jet pump for a pressure of 10^{-6} Torr.

II. Second version of diffusion pump used in experiments to find:

a. Other gases to be used in the diffusion process with UF_6.

b. New types of diaphragm to be used with UF_6 and fluorized hydrocarbon.

Sketch of Improved Diffusion Pump



Sketch of Improved Version of Diffusion Pump and Arrangement of Accessories

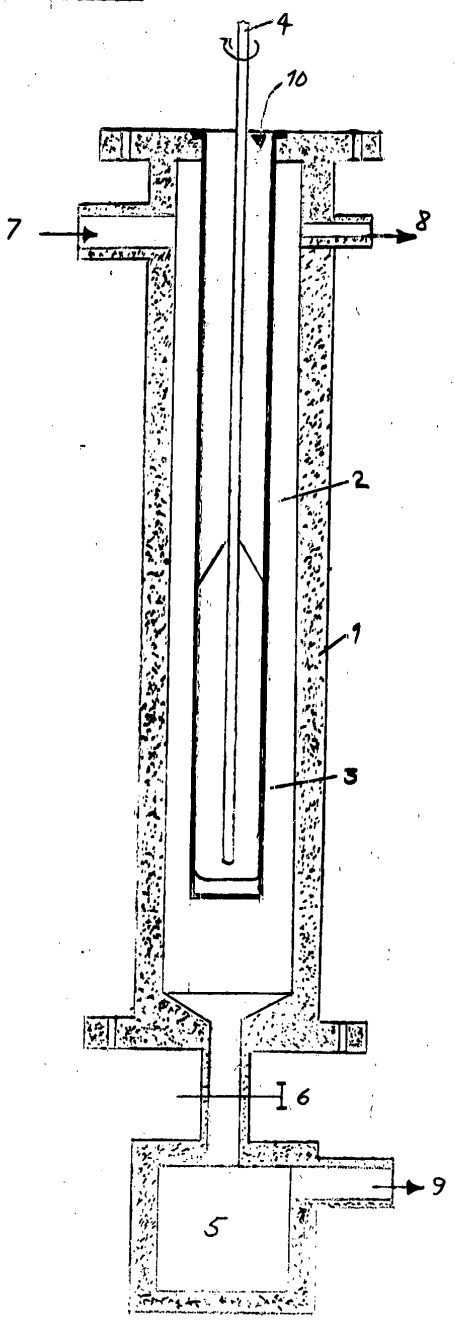
Legend:

1. Fluorized hydrocarbon, oil in substance, with a volatilization point at about 250 degrees centigrade under standard pressure.
2. Tubular nickel oxide diaphragm; snug fitted on nozzles, can be exchanged.
3. Exit of the enrichment of light isotopes.
4. Condensate of heavy isotopes.
5. Cooling water.
6. Intake of UF_6 gas.
7. UF_6 crystals, volatile at room temperature.
8. Valve to keep off fragments, equipped with nickel hammer.
9. High vacuum jet pump with a pressure of 10^{-6} Torr.
10. Pressure gauge.

Layout and Operation Process:

The pump was a stage of a three-step cascade. The valve (8) and the high vacuum valve (9) were closed when the process started. The entire cascade was preevacuated by a standard pump to a pressure of 10^{-3} Torr through the exit (3) of the last pumping stage, subsequently the first stage was evacuated by the high vacuum pump (9) and then closed. After the heating of the oil (1) and the opening of the valve (8) the diffusion process started at a vacuum pressure accordingly reduced to 10^{-4} Torr. The gas passing through the nozzles at the diaphragm, caused a whizzing noise which continued during the entire process.

Sketch of Deaerator



Sketch of Deaerator

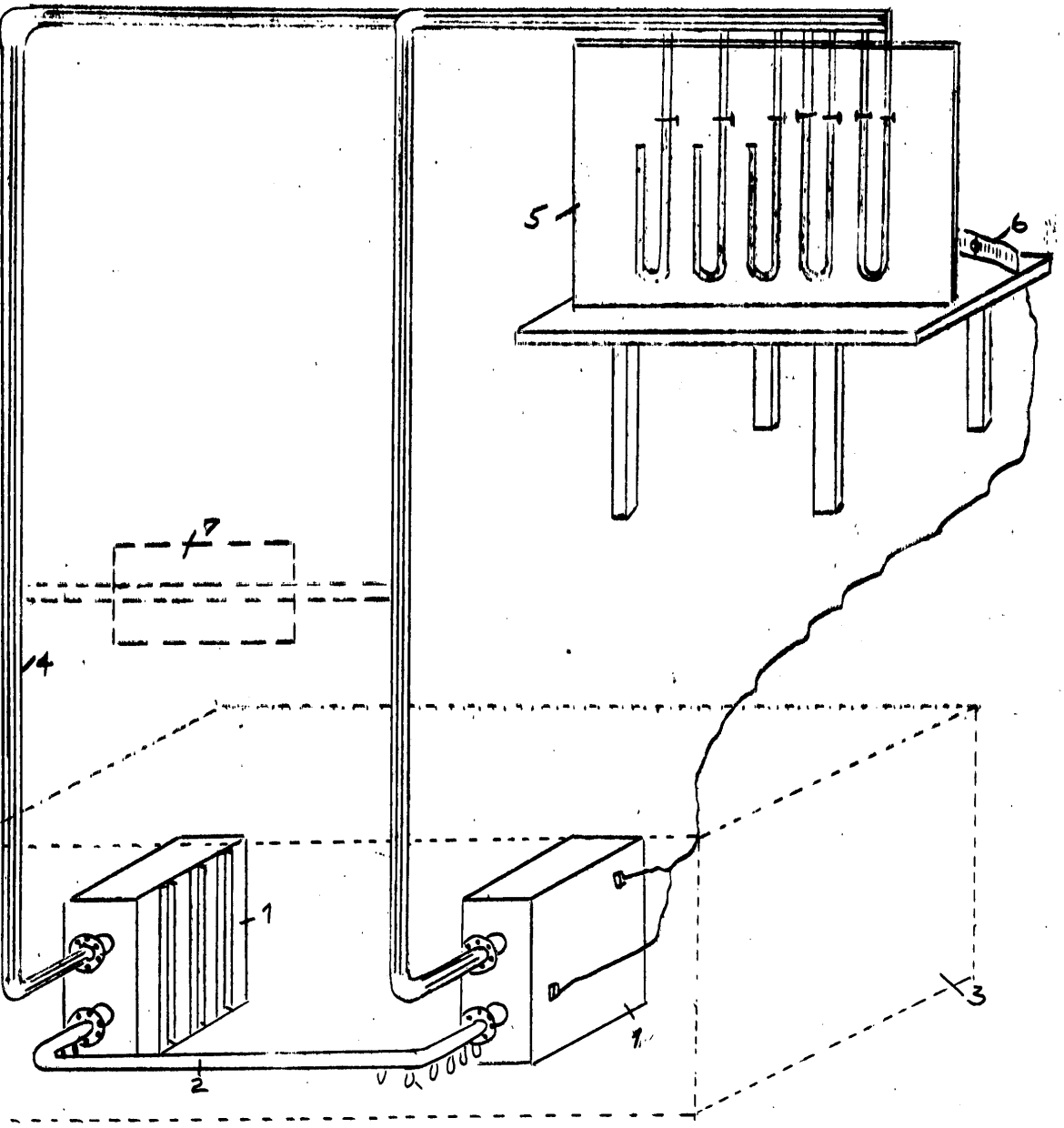
Legend:

1. Thick walled steel tube, about 30 cm in diameter and about 150 cm long,with threaded flanges at the ends.
2. Thin walled copper cylinder.
3. Eccentric of shaft (F).
4. Slowly rotating shaft.
5. Vaporizer (?) pot.
6. Valve (s).
7. UF_6 gas inlet.
8. Exit of separated air.
9. Discharge of purified UF_6 gas.
10. Cooling agent of very low temperature (liquid air proved to be too cold and another unknown cooling agent was used).

Operational method:

The air containing UF_6 gas was fed into the unit (7) and crystallized at the lower part of the cooling jacket, while the air escaped through the exit (8). The flexible walls of the cooling jacket are pushed in by the eccentric which breaks off the crystal cover.

Sketch of Diffusion Boxes



Sketch of Diffusion Boxes

Legend:

The term "boxes" referred to the temperature casing, which in turn contained the two diffusion boxes.

1. Steel casing, about 30 x 60 x 90 cm, made of steel sheets, five to ten mm thick. The casing was internally nickel plated and externally reinforced by T profiles; its front part was removable.

2. Connection pipe provided with sampling ampules between the lower flanges.

3. Thin walled sheet metal temperature casing covering two diffusion boxes.

4. Bundles of pipes extending from the upper intakes or outlets.

5. Oil pressure gauge operating with fluorized hydrocarbon; a maximum scaling of 100 cm, the sides were about 50 cm wide.

6. Reflection galvanometer with lead-ins of about 20 heating elements from the diffusion boxes.

7. Cooling agent for lead-ins into the upper intakes of the diffusion boxes.

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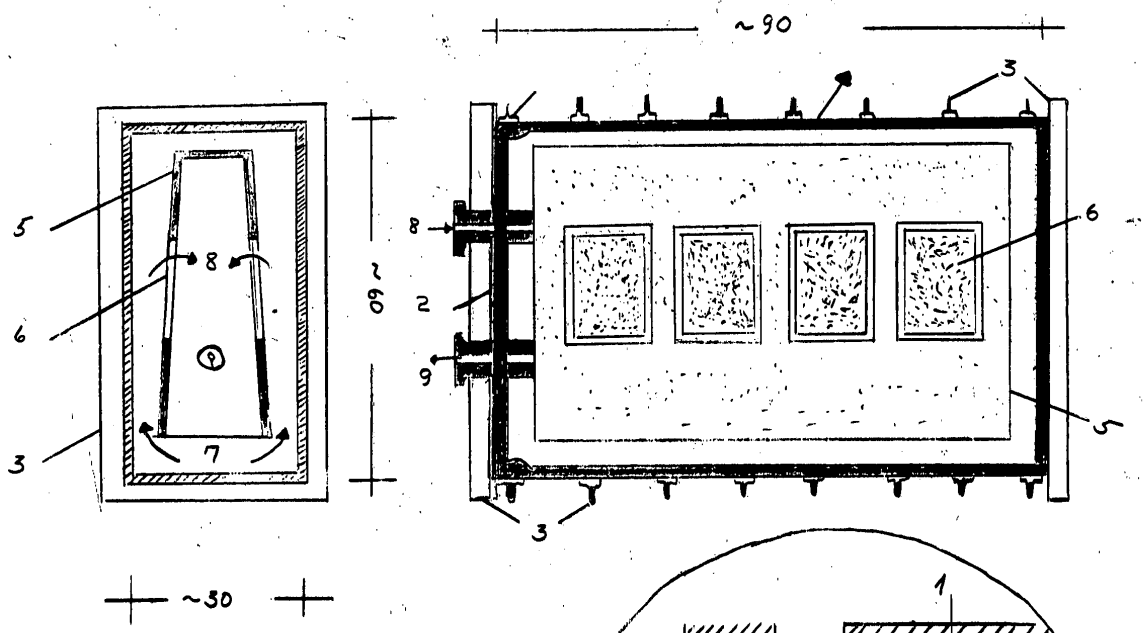
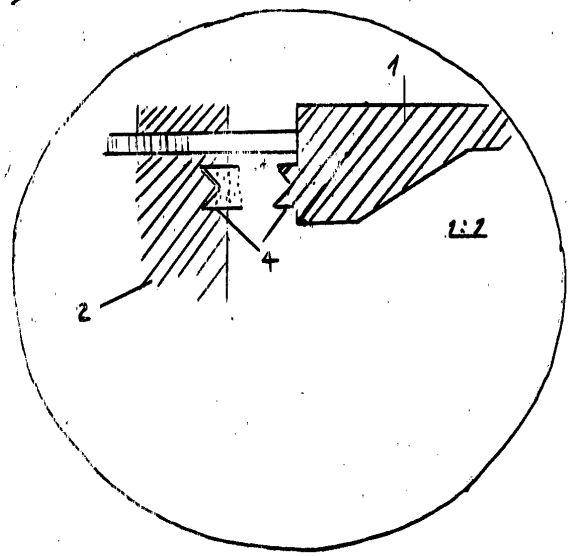
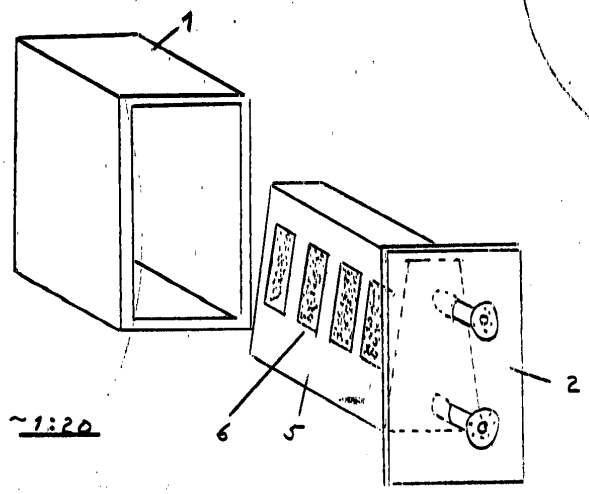
Detailed Sketch of Diffusion Box







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Detailed Sketch of Diffusion Box

Legend:

The sketches show: Cross section, longitudinal section, fitting of lid, and how to push the internal system into the box.

1. Nickel plated walls of diffusion box, five to ten mm thick.
2. Removable lid of box.
3. T-profile reinforcement of walls.
4. Copper sealing between box and lid.
5. Thin walled nickel casing, probably with open bottom.
6. Nickel oxide diaphragm plates of dull grey shade, about 12 x 18 cm, inserted with fillets.
7. Vaporizing UF_6 crystals.
8. Cooling area.
9. Zone of diffusion (discharge of the enrichment of light isotopes).

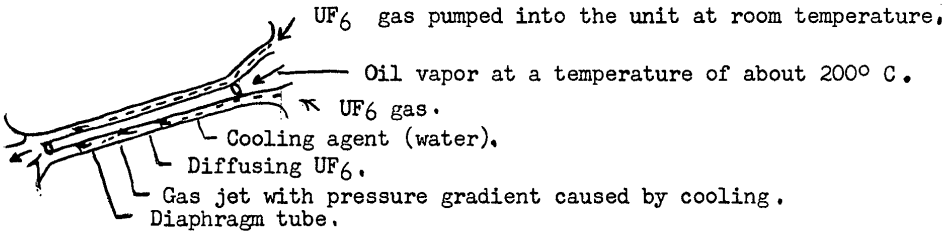
Operational Process:

UF_6 crystals were probably kept in the area below the casing. The vapor forced its way into the space outside of the diaphragm walls, which, being cooled from the inside (8), caused the light isotopes to pass through the diaphragm and to collect inside the box (9), from where the enrichment was discharged. The heavy fraction repeated the cycle. The combined functioning of the two boxes could not be determined.

TIME TABLE OF ACTIVITIES AT THE PROFESSOR HERTZ INSTITUTE IN AGUDZERI

	1945	1946	1947	1948	1949	1950
Hertz	Separation of neon with mercury (continuation of previous activities).		Diffusion of UF_6 with fluorized hydrocarbon by means of slotted metal tubes in a glass instrument.		Nickel oxide diaphragm in a glass instrument.	
Muehlenpfordt		Deaerator.		First diffusion box made of metal.	Second diffusion box made of metal.	
Schuetze		Mass spectroscope and mass spectrograph.				
Ickert		Experiments to find an UF_6 corrosion resistant material. Result: Nickel.		Improvement of nickel oxide diaphragm.		
Reichmann (Yermin)		Development of diaphragm; result: nickel oxide tubes.		Production of nickel oxide diaphragm		
Other institutes					Visits of an engineer from a metallurgical plant to prepare mass production of diffusion boxes (press drawing process)	

Diffusion Pump Developed at the Professor Hertz Institute



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